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(see #2 for follow-up Report)

Level II Contaminant Investigation of Overflow National Wildlife Refuge, Wilmot, Arkansas

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May 16, 1990

LEVEL II INVESTIGATION
OVERFLOW NATIONAL WILDLIFE REFUGE

A. Background

Overflow National Wildlife Refuge (NWR) is a prime Mississippi River Delta refuge that is important to waterfowl. Currently, there are about 8100 acres of bottomland hardwoods with creeks, sloughs, and cleared land. Additionally, about 1500 acres of agricultural land has been converted to refuge wetlands. An additional 7400 acres, of primarily farmland, was proposed for acquisition to the existing refuge (see Figure 1). Contaminant levels in the fish tissue collected during a routine refuge survey in 1986, (FWS 1986) and water samples collected by EPA near the lower end of Overflow Creek (the major drainage from the refuge) indicated elevated levels of mercury, selenium, and organochlorine compounds. A Level II survey was therefore necessary before the acquisition of the additional 7400 acres of land could be completed. In 1989, a Level II contaminant survey was conducted by the Vicksburg, MS Field Office to 1) identify changes (1986 to 1989) in organic and inorganic contaminant levels in fish tissue, 2) complete residue analysis of sediments to determine possible sources of contamination, and 3) determine if sources of contamination originated from the proposed acquisition land.

B. Procedures

Sampling site selection for 1989 collections (Figure 2, Table 1) was based on recommendations of refuge personnel familiar with the drainage area and to duplicate sampling locations for fish collections made in 1986. Water quality parameters were measured to determine spacial variation throughout the refuge and the proposed acquisition land. Field collections for the sediments were made with a petite ponar dredge (15 X 15 cm). Replicate samples (3 to 5) were collected and pooled before being placed in precleaned glass containers. All samples were immediately placed on ice. Upon return from the field all samples were frozen. Fish from OV-3 and OV-20 were collected with a boom electrofishing boat with pulsed D.C., in December 1989. Fish form OV-11 were collected in September 1989 by netting as water was released from the drainage area. All fish were measured, weighed, wrapped in foil, and placed on ice. Upon returning from the field all fish were frozen.

Sediment samples were collected in the two main incoming tributaries that feed Overflow NWR (Beech Creek and Overflow Creek), drainage within the present boundaries, and areas that drain from the refuge (Overflow Creek). Collections of fish tissue from 1986 indicated elevated concentrations of mercury and selenium and levels of DDT and its derivatives approaching levels of concern. Initial analyses (completed 2/2/90) were for mercury and selenium in the sediments, both predator and benthic feeding fishes, and for organochlorines in the benthic feeding fishes only. The organochlorine analysis for benthic fish showed additional analyses for organochlorines in the sediments and predator fish tissue was needed for a better understanding of potential contaminant sources. Chemical analysis for organochlorines and dicofol in fish tissue followed Cromartie et al. (1975) and Krynitsky et al.

(1988), respectively. Mercury was analyzed by procedure described by Monk (1961) and selenium by methods described by Krynitsky (1987).

C. Results

Conductivity and turbidity exhibited the greatest variation of the water quality parameters measured at Overflow NWR and the proposed acquisition land (Table 2). Highest values for both conductivity and turbidity were found at Flat Slough (site 11) inside the current refuge boundaries. The lowest values were found in Overflow Creek within the refuge boundary (site 1). Only three organochlorine compounds (DDD, DDE, and DDT) were detected in the sediment collections (Table 3). More organochlorine compounds were identified at or above detection limits in the bottom feeding fishes compared to the predator fishes (Table 4). Concentrations of mercury and selenium in sediments were all less that 1 ug/g (dry weight); however, concentrations of mercury and selenium in fish tissue were all at or above 1 ug/g (Table 5).

D. Conclusions

1) Water Quality--There was not enough variation in water quality measurements between sampling locations to warrant any further discussion.

2) Sediments--The only group of organochlorine compounds that was detectable in any of the sediment samples was the DDT and metabolites (DDTM). Overflow Creek above the refuge (Site 7) had sediments which contained DDT, DDE, and DDD; however, sediments in Overflow Creek inside the refuge (Site 1) did not have detectable DDTM. The dam site for the greentree reservoir had sediments with detectable DDTM but this may have been due to the drainage from a ditch (Site 4). The only other site on the refuge that had sediment with detectable concentrations of DDTM was in the upper portions of Walker Slough (Site 15). Bayou Bartholomew below the refuge had detectable concentrations of DDD and DDE but the parent compound DDT was below detection limits. Levels of mercury and selenium were highest in sediments collected in Overflow Creek, above and within the refuge (Sites 7 & 1), and in a drainage ditch at the north end of the current refuge (Site 8). Mercury and selenium concentrations were also elevated at the dam site on Overflow Creek (Site 3), Walkers Slough (Site 15), and at the drainage ditches at the far south end of the refuge (Site 17) on the Louisiana border (Tables 3 and 5).

3) Fish Tissue-- All Bottom feeding fish collected in 1989 had more compounds at or above detection levels than the predator fish from the same sampling sites. Concentrations of DDTM were lower in the predator fish than in the omnivorous feeders collected at the same sites. The highest concentrations of organochlorine compounds (particularly toxaphene) was found in fish collected from Bayou Bartholomew below Overflow NWR. Higher levels of toxaphene were found in all the fish collected in 1989 compared to those collected in 1986. Concentrations of mercury and selenium were similar at each sampling site (except carp at Site 20 in Bayou Bartholomew) and similar or slightly lower than concentrations detected from fish collected in 1986 (Tables 4 and 5).

4) Background/Action levels-- Sediment criteria for selenium concentrations for soils in the United States are not available. In Canada, allowable concentrations of selenium on agricultural land is 1.6 ppm (Richardson 1987). Great Lakes criteria for allowable concentrations of selenium in sediments dumped into open waters is 1.0 ppm-dry weight (Wisconsin DNR 1985). Several locations on Overflow NWR with selenium in the sediments were at concentrations exceeding the above mentioned criteria. Except for Bayou Bartholomew, the concentrations of selenium we found in the fish tissue were similar to that found in the sediments. Additionally, the concentrations of selenium in fish tissue from 1986 compared to 1989, were similar for both bottom feeding and predacious fish (Table 5). Recommended criteria for selenium in fish tissue is 5.4 ppm for fillets (EPA 1989).

Sediment criteria for mercury concentrations for soils in the United States are not available. Background levels for mercury in soils from the U.S. ranged from 0.02 to 0.11 ppm in uncontaminated areas of the North Central U.S., up to 4.1 ppm in contaminated sites (Martin and Hartman 1984). Agricultural land in Canada and the Netherlands allow 0.5 ppm mercury (Richardson 1987). Other sites around the world were more than 700 ppm in Japan (Skei 1978) and Finland (Paasivirta et al. 1983). Allowable levels of mercury in sediment or sludge for open water dumping in the Great Lakes are 0.1 ppm (Wisconsin DNR 1985). The bioconcentration factor of 5000 for mercury is very high and small quantities will accumulate in biota. The recommended levels that EPA (1989) has set for fish tissue is 1 ppm for fillets. Nearly all samples for whole fish analysis in and around Overflow NWR exceeded the recommended levels of mercury allowed by EPA standards. The levels of mercury in the fish tissue have either not changed or decreased from levels found in the same sampling site in 1986 (Table 5).

Sediment criteria for concentrations of DDT, DDD, and DDE for soils in the United States are not available. A short term study done by Louisiana State University in 1981-82 on sediment concentrations of DDTM near Lake Providence, LA, indicated field levels of up to 1 ppm with 71% attributable to DDT. Lake and Bayou sediment DDTM levels in the same area were about 0.3 ppm with about 20% of the total DDTM from DDT (Lowe 1984). Criteria for DDT in sediments for open water disposal into the Great Lakes is .01 ppm (Wisconsin DNR). Levels of DDTM in the sediments in and around Overflow NWR were up to 0.1 ppm in Overflow Creek above the refuge (Site 7) and in the drainage ditch near the dam structure for the greentree reservoir (Site 4). The main components of DDTM in the sediments from Overflow NWR were DDE (42%), DDD (32%), and DDT (26%). In fish tissue, mean values for total DDTM in the United States has decreased from 1976-1984 (Schmitt et al. 1990). Levels of DDTM from all Overflow NWR samples (geometric mean 1986= .63, 1989= .67 ppm) were higher than the national mean concentration of DDTM in 1984 (geometric mean =0.26 ppm). Even though the mean value of DDTM in 1989 is slightly higher than in 1986 for all fish collected, the fish collected only on the existing refuge or acquisition land (excluding Bayou Bartholomew) is considerably lower (geometric mean 0.36 ppm). Fish samples on Overflow NWR collected in 1986 had DDE, DDD, and DDT accounting for 86, 8, and 6 %, respectively of DDTM. In 1989 DDE, DDD, and DDT on the refuge accounted for 62, 19, and 19 %,

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respectively of DDTM. These trends are not typical of what the National Contaminant Biomonitoring Program has indicated, with lower amounts of DDT in relation to the other metabolites (Schmitt et al. 1990).

Sediment criteria for concentrations of toxaphene in soils of the United States are not available. The maximum allowable concentration of toxaphene in soils from USSR was 0.5 ppm (Beyer 1989). Concentrations in sediments for open water dumping into the Great Lakes is 0.05 ppm (Wisconsin DNR). All of the sediment residue samples for toxaphene from Overflow NWR were below detection limits. However, several studies (Eisler 1985) have indicated the absence of toxaphene from soil/sediment samples but high concentrations in biota, particularly with each increasing trophic level. This demonstrates the high bioconcentration factor (13100 L/kg) that has been determined for toxaphene by EPA (1989). Levels of toxaphene in fish tissue from Overflow NWR were all high in 1989, exceeding 1986 levels by at least one order of magnitude (Table 6). The differences in levels of toxaphene between 1986 and 1989 is of concern. Possible explanations include - residue analyses of fish tissue was conducted by different laboratories - or heavy amounts of toxaphene were applied to the cotton field before our field collections. There is no knowledge of recent use of toxaphene in Overflow watershed; however, refuge personnel know that quantities of toxaphene are available for local farming practices. The range of toxaphene concentrations in 1989 was from 1.2 ppm in yellow bullhead at site 11 to 8.1 ppm in largemouth bass in Bayou Bartholomew. Additionally, the largemouth bass from Bayou Bartholomew were small, averaging 177 g per fish, compared to an average of 431 g for the largemouth bass collected inside the refuge at site 11. Carp collected at the dam site for the greentree reservoir and in Bayou Bartholomew were nearly identical in size and in the concentrations of toxaphene in the whole fish residue. Even though the levels of toxaphene in the refuge are smaller than in Bayou Bartholomew, the concentrations found in fish collected from Overflow NWR exceed the criteria set by EPA (1989) for fish tissue concentrations of 0.0098 ppm.

E. Recommendations

Overflow Creek watershed lies separate from the Bayou Bartholomew watershed, within a confined watershed of about 22340 hectares (55200 Acres). Over 50% of the watershed is woodland with the remainder agricultural, or homesteads, etc (U.S.D.A.-Soil Conservation Service, Hamburg, AR). Over 32% of the agricultural land now used for growing cotton will be taken out of production. Reforestation of the new land is scheduled immediately upon acquisition. The level II survey indicates that the acquisition land is not responsible for contamination of the refuge. Even though there are substantial problems with contamination around the refuge, the source of contamination appears to be from above the acquisition land or from the Bayou Bartholomew watershed. Except for toxaphene, levels of contaminants (mercury, selenium, and DDTM) in the fish tissue have either remained the same or decreased slightly from 1986 to 1989 (Tables 4,5 and 6).

The refuge and the adjacent farmland are heavily used by waterfowl during the wet wintering period. With the acquisition of the additional land, portions of agricultural land will be taken out of production. The potential for

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insecticide and herbicide contamination to fish and migrating waterfowl will be reduced. In conclusion; 1) there is no apparent contamination to the existing refuge from the proposed acquisition land, 2) much of the currently operational agricultural land with its' application of herbicides and insecticides will be taken out of production, 3) Except for toxaphene, contaminant concentrations have either remained the same or decreased, and 4) the major source of any contamination near the refuge appears to be from above the acquisition land or from an adjacent watershed. I therefore recommend purchase of the acquisition land for the U.S. Fish and Wildlife Service Refuge system, namely Overflow National Wildlife Refuge. However, the advisory for the consumption of fish collected from the existing refuge and the acquisition land should be continued and an additional survey of residue analysis of similar fish be conducted at least every two years to monitor residue levels of mercury, selenium, DDTM and toxaphene. The consumption advisory should continue until the residue analysis indicates lower levels of the aforementioned contaminants.

E. Certification

"On the basis of the information gained from the investigation, there is a reasonable probability to conclude that contaminants and/or the effects of contaminants may be present on this real estate. However, no clean up or mitigation of contaminated sites is necessary and therefore, no clean up costs will be incurred as a result of land acquisition. The acquisition of an interest in this real estate may proceed, with the knowledge that occasional monitoring needs to be completed before public fishing is allowed on the refuge."

F. Signature and Approval

_____ _____

Contaminant Specialist
Vicksburg Field Office
Vicksburg, MS

Date

I concur with the recommendation.

_____ _____

Assistant Secretary for Fish and Wildlife and Parks Date

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Appendix A

Listing of organochlorine Compounds analyzed in fish tissue and sediments from Overflow NWR--December 1989 (abreviations as listed in Tables 2 and 3).

PCB/1254--Polychloinated biphenyls/ anachlor 1254

oxch--oxychlordane

Hep.epox--Heptachlor epoxide

t-nanochlo--trans nanochlor

c-nanochlo--cis-nanochlor

t-chlo--trans chlordane

a-chlo--alpha chlordane

pp DDE--dichlorodiphenyldichloroethylene

pp DDD--1,1-dichloro-2,2-bis(p-chlorophenyl)ethane

op DDD--1,1,-dichloro-2(o-chlorophenyl)-2-(chlorophenyl)ethane

pp DDT--1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane

toxo--toxaphene

op-Dico-- o'p' Dicofol

pp-Dico-- p'p' Dicofol

pp-DCBP-- dichlorobenzophenone

deil--dieldrin

endr--endrin

Appendix B

REMEDIAL ACTION PLAN FOR ADDRESSING CONTAMINANT ISSUES ON SERVICE LANDS

Field Station: Overflow NWR
(Satellite of Felsenthal NWR, Crossett, AR)

Preparer: Michael T. Murphy
Asst. Refuge Manager

Date Prepared: June 4, 1986

Description of the Issue

(1) Contaminant(s) causing the issue:

Contaminants present include fertilizers, pesticides and herbicides in agricultural runoff which drains through Overflow NWR. Contaminants identified just downstream from the refuge in Overflow Creek include:

- Heavy metals: cadmium, chromium, lead, mercury and zinc;
- Chemicals: aldrin, dieldrin, endrin, endosulfan, heptachlor and toxaphene;
- Elements: arsenic;
- Biological agents: fecal coliform and strep.

(2) Data required:

a. Biological impacts of the contaminant(s):

A number of chemical and metal contaminants may exceed EPA criteria values for the 24-hour average necessary to protect fresh water aquatic life. Biological organisms may exceed EPA criteria for human health. Both contaminants and organisms need to be sampled on the refuge to make that determination.

Toxic concentrations of these heavy metals have a variety of deleterious effects on the morphology and physiology of fresh water fish and aquatic invertebrates. Among these effects are: reduced oxygen intake, metabolic changes, weight loss, tissue damage, reproductive disruption, and/or death. The toxicity of the compounds is affected by water temperature, hardness, pH, and dissolved oxygen. Bioaccumulation can occur in a food chain, resulting in disrupted morphology and/or physiology in fish-feeding birds including raptors.

Chemicals which were found just downstream and may be found on Overflow refuge fall into the organochlorine (chlorinated hydrocarbons) group. Except for toxaphene, the other chemicals are cyclodiene (diene-organochlorines) insecticides, which

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are persistant in the environment. The cyclodienes are generally equitoxic, that is, they have equal toxicity to insects, fish, birds, and mammals (given equal weight). Fish are more susceptible due to the fact that their total environment exposes them to the insecticides. Cyclodienes are neurotoxicants, destroying the sodium and potassium balance within a neuron. This leads progressively from nervous activity through tremors, convulsions, and prostration, to death. Bioaccumulation can occur in the food chain.

Toxaphene is a polychloroterpene insecticide, used almost exclusively on cotton. It has low insect toxicity and is easily metabolized by mammals. Fish, however, are quite susceptible to toxaphene as a neurotoxicant.

b. Habitat value of the impacted area:

Overflow NWR is a predominantly bottomland hardwood area in the lower Mississippi River delta. It currently encompasses 7,023 acres composed of over 6,800 acres of bottomland hardwood forest with associated creeks, sloughs and beaver ponds, and less than 200 acres of uplands and cleared rights-of-way. Approximately 4,000 acres of the bottomland hardwoods are flooded in the fall for wintering waterfowl. Up to 30,000 waterfowl utilize the area during the winter.

c. Chemical characteristics of the contaminant(s):

Heavy metals

- Cadmium - a soft metal, usually found as a sulfide salt. Commonly associated with zinc and lead ores. Biologically nonessential element which can be highly toxic.

- Chromium - Biologically essential trace element for humans. The 17th most abundant non-gaseous element, found in air, soil, and most biological systems.

- Lead - A heavy metal that's toxicity is affected by pH, hardness, and the presence of other organic and metal materials. Can act as a cumulative poison.

- Mercury - A heavy metal which is highly toxic and accumulates in living systems. Human poisoning can be acute or chronic. Can occur in elemental form or dissolved organic and inorganic forms. Certain microorganisms are known to convert soluble mercury into highly toxic methyl and dimethyl mercury.

- Zinc - Usually occurs as a sulfide associated with lead, copper, cadmium and iron. Its toxicity is affected by pH, hardness, dissolved oxygen, and temperature.

Chemicals

- Aldrin, Dieldrin, Endrin, Endosulfan (Thiodan), Heptachlor, and Toxaphene (Attac, VerTac) -

  Organochlorines (chlorinated hydrocarbons) which may be toxic or potentially carcinogenic through ingestion of contaminated water or contaminated aquatic organisms. These chemicals, some discontinued, were/are used as pesticide and/or insecticide agents.

Elements

- Arsenic - A toxicological element commonly found in nature. Toxicity can be additive, and is more toxic to mammals and aquatic species in inorganic form.

d. Quantity of the contaminant(s) at the site:

Sampling of Overflow Creek near Bonita, LA (approximately 6-8 miles downstream from the refuge) indicated the following contaminant quantities.

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Table 1. Sampling sites for Overflow National Wildlife Refuge restudy-1989.

No.	AS	MFP	CC	SC	SiC	LA	LO	CD	GS	SaC	ST
OV-1-S	.3	ice/ freeze	Ashley	AR	UKN	330500	914036	0504	080402	528 g	SED
OV-3-S	"	"	"	"	"	330254	914030	"	"	510 g	"
OV-4-S	"	"	"	"	"	330254	914006	"	"	602 g	"
OV-6-S	"	"	"	"	"	330742	913924	"	"	767 g	"
OV-7-S	"	"	"	"	"	331024	913630	"	"	565 g	"
OV-8-S	"	"	"	"	"	330654	913748	"	"	498 g	"
OV-9-S	"	"	"	"	"	330606	913812	"	"	643 g	"
OV-10-S	"	"	"	"	"	330654	913812	"	"	529 g	"
OV-11-S	"	"	"	"	"	330530	913830	"	"	614 g	"
OV-13-S	"	"	"	"	"	330536	913918	"	"	639 g	"
OV-15-S	"	"	"	"	"	330512	913618	"	"	411 g	"
OV-17-S	"	"	"	"	"	330024	914030	"	"	489 g	"
OV-18-S	"	"	Morehouse Parrish	LA	"	325854	914206	2205	"	590 g	"
OV-20-S	"	"	"	LA	"	325842	914154	2205	"	723 g	"

AS-analytical sensitivity, MFP-method of field preparation, CC-county collected
SC-state collected, SiC-site classification, LA-latitude, LO-longitude
CD-congressional district, GS-USGS watershed code, SaC-sample comments
ST-sample type

Table 3. Organochlorines (ug/g wet wt.--ppm) from sediments collected from Overflow National Wildlife Refuge--December 1989 (site listed numerically), see Appendix A for list of Organochlorine compounds.

1	3	4	6	7	8	9	10	11	13	15	17	18	20	Cmpd
528	510	602	767	565	498	643	529	614	639	411	489	590	723	WT (G)
60	62	53	22	60	51	42	39	40	25	73	45	32	40	% mois
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	PCB /1254
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	oxchl
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	Hep. Epox
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	t-nano chlor
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	c-nano chlor
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	t-chlor
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BLD	BDL	BDL	BDL	BDL	BDL	BDL	a-nanno
BDL	.02	.05	BDL	.03	BDL	BDL	BDL	BDL	BDL	.025	BDL	BDL	.015	pp-DDE
BDL	.02	.03	BDL	.04	BDL	BDL	BDL	BDL	BDL	.017	BDL	BDL	.018	pp-DDD
BDL	BDL	.03	BDL	.02	.011	BDL	BDL	BDL	.011	.015	BDL	BDL	BDL	pp-DDT
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	toxop
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	Dicof ol
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	pp-DCBP
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	dield
BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	endri n

BDL = BELOW DETECTION LIMITS

Table 4. Organochlorine compounds (ug/g wet wt.--ppm) from fish tissue collected from Overflow in NWR 1986 and 1989. Collections from 1986 near Greentree spillway only---1989-Site 3-spillway, Site 11- NE corner of refuge near water reg. structure, Site 20-Bayou Bartholomew below Overflow Creek input. See Appendix A for list pf organochlorine compounds.

Cmpd	86 CC[1]	86 BF	86 BG	86 WC	86 GS	86 LMB		89 3-BF	89 3-CP	89 11-LMB	89 11-YB	89 20-LMB	89 20-CF
WT	502	3074	553	1128	986*	1848		2172	6965	2157	1914	888	6836
lip	2.24	2.59	3.7	2.86	3.64	2.41		12.6	.79	22.4	.30	37.2	.56
PCB/ 1254	-	-	-	-	-	-		BDL	BDL	BDL	BDL	BDL	BDL
oxch	nd	nd	nd	nd	nd	nd		BDL	BDL	BDL	BDL	BDL	BDL
Hep. Epox	nd	nd	nd	nd	nd	nd		BDL	BDL	BDL	BDL	BDL	BDL
t-nano chlo	.01	nd	.01	.01	nd	.01		BDL	.016	BDL	BDL	BDL	.010
c-nano chlo	nd	nd	nd	nd	nd	nd		BDL	.027	BDL	BDL	BDL	.019
t-chlo	nd	nd	nd	nd	nd	nd		BDL	BDL	BDL	BDL	BDL	BDL
a-nann	-	-	-	-	-	-		BDL	.012	BDL	BDL	BDL	.011
pp-DDE	.49	.69	.78	.99	.14	.75		.036	0.94	.27	0.14	2.6	1.2
pp-DDD	.04	.05	.10	.07	.03	.05		.041	.23	.12	.049	.67	.25
op-DDD	nd	ND	ND	ND	ND	ND		-	.035	-	.013	-	.041
pp-DDT	.01	.06	.07	.11	nd	.04		.039	BDL	.059	BDL	.39	BDL
toxo	.13	.52	.44	.53	.09	.23		1.6	2.3	1.9	1.2	8.1	2.3
op-Dico	-	-	-	-	-	-		-	BDL	BDL	BDL	-	BDL
pp-Dico	-	-	-	-	-	-		BDL	BDL	BDL	BDL	BDL	BDL
pp-DCBP	-	-	-	-	-	-		BDL	BDL	BDL	BDL	BDL	BDL
diel	nd	nd	nd	nd	nd	nd		BDL	.016	BDL	.01	BDL	.015
endr	nd	nd	nd	nd	nd	nd		BDL	BDL	BDL	BDL	BDL	BDL

[1] CC-channel catfish, BF-bowfin, BG-bluegill, WC-white crappie, GS-gizzard shad, LMB-largemouth bass, CP-carp, YB-yellow bullhead.

nd = not detected, - not analyzed, BDL- below detection limits

Table 5. Mercury (Hg) and Selenium (Se) (ug/g dry weight--ppm) in fish tissue and sediments from Overflow NWR in 1986 (Fish only) and 1989.

1989 Sample	1989 Weight	1989 Hg dry	1989 Se dry	1986 Sample	1986 Weight	1986 Hg dry	1986 Se dry
Ov-3-T1 (Bowfin)	2199	1.0	1.2	OV-1-CHC catfish	502	0.8	1.4
OV-3-T2 (Carp)	6965	0.8	1.3	OV-1-BF Bowfin	3074	2.0	1.1
OV-11-T1 (LMB)	2279	1.3	1.7	OV-1-BGS bluegill	553	1.0	1.2
Ov-11-T2 (Y.Bull)	1914	1.1	0.9	OV-1-BKS crappie	1128	2.6	1.5
OV-20-T1 (LMB)	879	1.4	1.6	OV-1-GSH shad	986	0.2	1.3
OV-20-T2 (Carp)	6836	3.2	1.3	OV-1-LMB bass	1848	1.8	1.3
OV-1-S	425	0.24	1.6				
OV-3-S	504	0.16	1.8				
OV-4-S	616	0.10	0.9				
OV-6-S	727	0.06	0.6				
OV-7-S	562	0.20	1.2				
OV-8-S	497	0.25	1.4				
OV-9-S	527	0.09	0.2				
OV-10-S	427	0.07	1.0				
OV-11-S	652	0.05	0.9				
OV-13-S	366	0.07	0.9				
OV-15-S	410	0.15	1.6				
OV-17-S	478	0.10	1.0				
OV-18-S	582	0.03	0.2				
OV-20-S	712	0.05	0.2				

Table 6. Concentrations of DDE and Toxaphene (ug/g-wet weight-ppm) present in fish tissue from collections made in 1986 and 1989 at Overflow National Wildlife Refuge.

		Omnivores	Piscivores
	SITE 3		
1986			
	DDE	0.64	0.64
	Toxaphene	0.35	0.29
1989			
	DDE	0.94	0.10
	Toxaphene	2.3	1.6
	SITE 11		
1989			
	DDE	0.14	0.27
	Toxaphene	1.20	1.90
	SITE 20		
1989			
	DDE	1.20	2.60
	Toxaphene	2.30	8.10

Omnivores-1986 = Bluegill, White Crappie, Gizzard Shad
1989 = Yellow Bullhead, Carp

Piscivores-1986 = largemouth Bass, Bowfin, Channel Catfish
1989 = largemouth bass, Bowfin

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Figure 1. Overflow National Wildlife Refuge--current boundries and proposed land for acquisition.

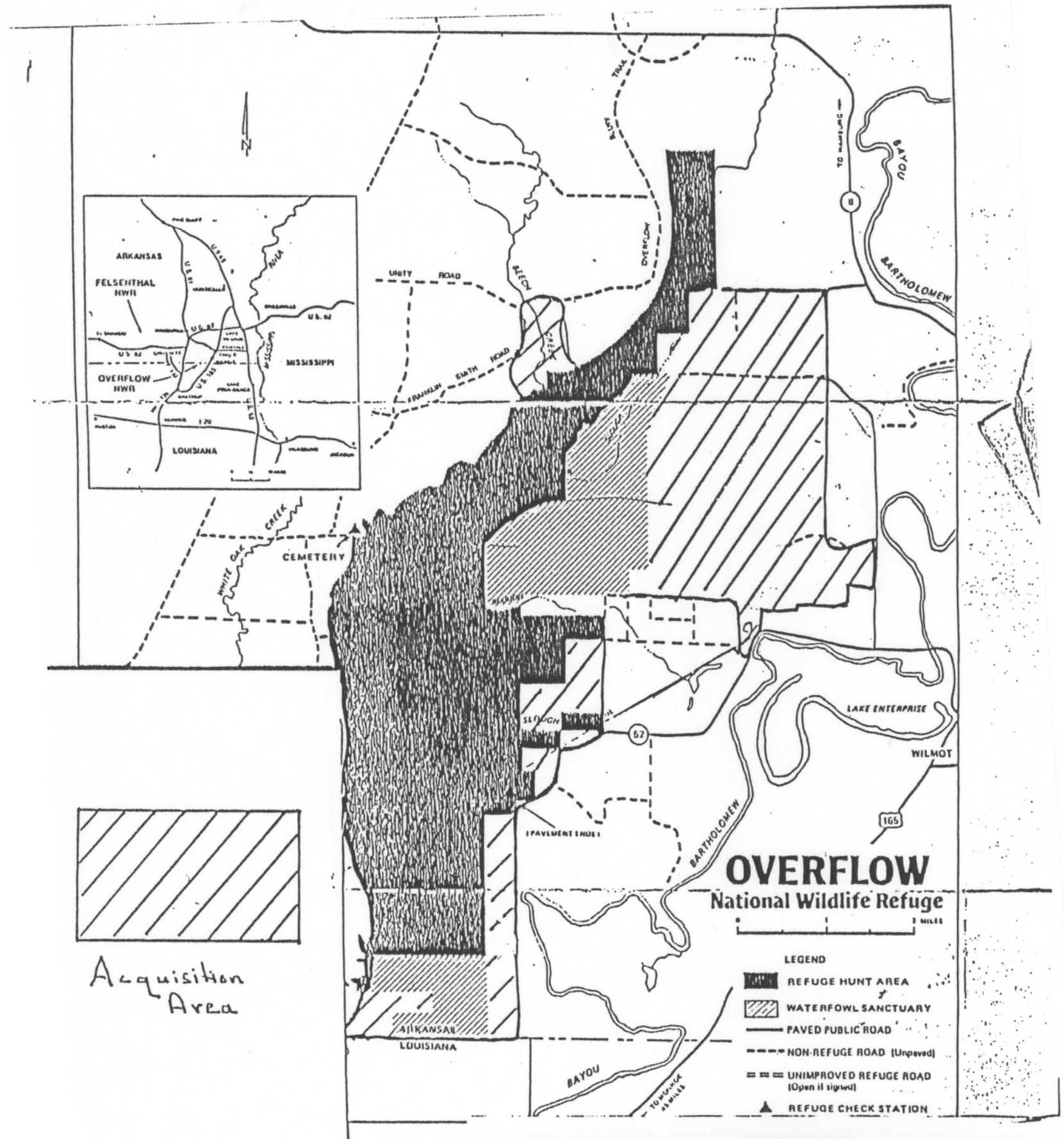
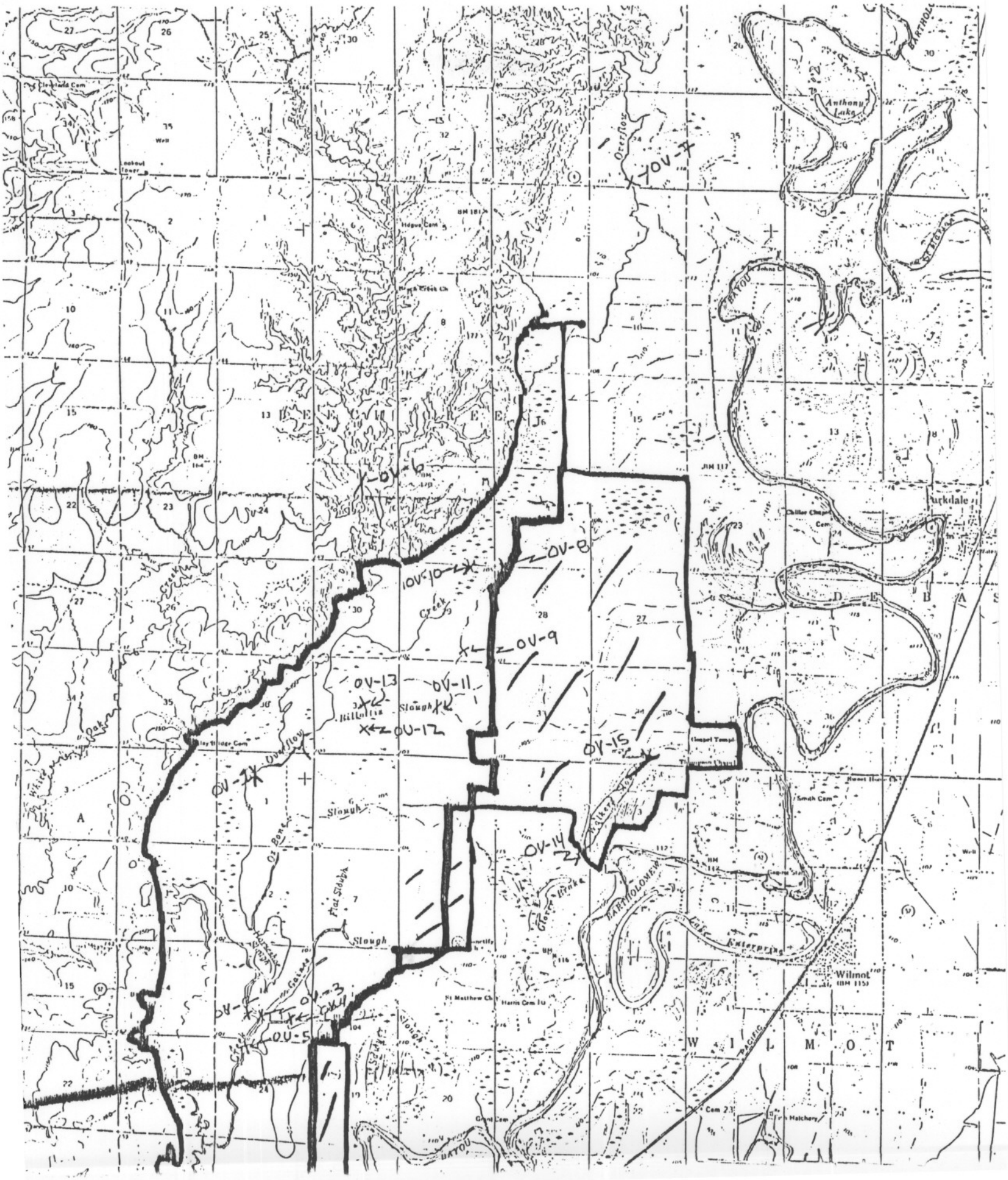


Figure 2. Sampling sites for collection of sediments and fish from Overflow National Wildlife Refuge-- 1989.



Region 4 Overflow NWR (3/20/86)

Refuge Contaminant Issues of Concern

Prior. Rank #	Issue	FY 1986 Programmed Fund.-Task (Needed Fund.-Task)	FY 1987 Proposed Fund.-Task (Needed Fund.-Task)	FY 1988 Proposed Fund.-Task Needed Funds-Task	Comments
1	Overflow NWR - agricultural runoff - heavy metals & organo-chlorines.	None programmed. ($8k - RCA) Need to begin intensive contaminant survey on refuge. Collect and analyze fish and water samples.	None programmed. ($20k - RCA) Continue contaminant survey. Collect/ analyze fish, birds, vegetation, sediments; assess water quality.	None programmed. ($10k - R&D) Depending on results of previous years work, may need to develop a hydrological model to determine water management options.	Contaminants have only recently been identified and were not included in refuge budget considerations for FY 1986-87. Evidence strongly suggests that this is a problem requiring corrective action. Agricultural runoff has resulted in excessive contaminant values found in water just downstream from the refuge.

Attachment No. 1